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10/538,414	12/21/2005	Nigel-Philip Cox	2002P17911WOUS	3588

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SIEMENS CORPORATION
INTELLECTUAL PROPERTY DEPARTMENT
170 WOOD AVENUE SOUTH
ISELIN, NJ 08830

EXAMINER	
VELASQUEZ, VANESSA T	

ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/538,414	COX ET AL.	
	Examiner	Art Unit	
	Vanessa Velasquez	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *26,28,29,33 and 36-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *26,28,29,33 and 36-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-25 remain canceled. Claims 27, 30-32, 34, and 35 are canceled. Claims 26, 28, 29, 33, and 36-50 are presented for examination.

Status of Previous Rejections under 35 USC § 112

The previous rejection of claims 28 and 39 under the second paragraph of 35 U.S.C. 112 is withdrawn in view of Applicant's amendment to the claims.

The previous rejection of claim 46 under the second paragraph of 35 U.S.C. 112 is withdrawn in view of Applicant's amendment to claim 26, from which claim 46 directly depends.

Claim Rejections - 35 USC § 112, Second Paragraph

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 26, 28, 29, 33, and 36-50 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 26 recites that "a holding time for the improvement heat treatment is dispensed with or reduced because it has been completely or partially effected by a holding time for the improvement heat treatment." The latter reference to the

improvement heat treatment makes the claim illogical. The holding time of the heat treatment would be reduced by holding time of a previous step, not the current heat treatment step. The Examiner will interpret the claim such that the holding time of the redensifying step reduces the holding time of the improvement heat treatment step. This interpretation is consistent with the specification (see page 4, para. [0029]). Claims 28, 29, 33, and 36-50 are dependent on claim 26, and are therefore likewise rejected.

Claim 36 is rejected for being dependent on a canceled claim. For the purposes of examination, the claim will be interpreted as being dependent on claim 26.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 26, 28, 29, 33, 37-39, and 43-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vogt et al. (US 6,120,624) in view of Lake (US 1,531,445), and further in view of Higgins (*Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th edition).

Regarding claims 26, 33, 37, 38, and 44, Vogt et al. teach the application of a heat treatment process to nickel-based base superalloys to improve the weldability of said superalloys. More specifically, the process involves heating a nickel-based superalloy above its gamma prime solvus temperature to bring the gamma prime phase into solution, and then slowly cooling said superalloy to precipitate the gamma prime

phase. The gamma prime precipitations are coarsened by the slow cooling stage, forming an overaged structure (Vogt et al., col. 3, lines 35-45).

Still regarding claims 26, 33, 37, 38, and 44, Vogt et al. do not teach redensifying the cast component immediately after casting without cooling. However, Lake, drawn to a process of casting metal, teaches that molten metal is poured into a heated mold so that no cooling (of the metal) occurs (page 2, lines 93-97). While remaining heated, the metal is made denser by the application of pressure (Lake, page 2, lines 100-103). Applying pressure to the molten metal homogenizes the metal, eliminates blow-holes, and enhances the tensile strength of the metal (Lake, page 2, lines 104-108). Therefore, it would have been obvious to one of ordinary skill in the art to redensify the casting of Vogt et al. without cooling because immediate redensification fortifies the mechanical properties of the metal, as taught by Lake.

Still regarding claims 26, 33, 37, 38, and 44, Lake also teaches that after densification, the casting may be heat treated in the same heated mold (Lake, page 2, lines 112-118). Therefore, it would have been obvious to one of ordinary skill in the art to conduct the heat treatment step of Vogt et al. in the same mold that the casting is redensified because it eliminates the time it would take to transfer the casting to another chamber, thereby increasing efficiency and reducing equipment costs. Regarding the reduction in the holding time of the improvement heat treatment by the holding time of the redensification step, because there is no cooling between the casting and redensification step, the heat from the combination of the aforementioned steps would be expected to reduce the holding time of a subsequent heating step because the heat

from said steps is retained. The heat that is retained would, thus, be available to contribute to subsequent heat treatment steps, such as the aging treatment taught by Vogt et al., and therefore be able to reduce the holding time of a subsequent heat treatment step.

Still regarding claims 26, 33, 37, 38, and 44 and concerning the cooling rate limitation, Vogt et al. fail to teach the claimed cooling rate. However, it is emphasized that the heat treatment described in Vogt et al. represents time, temperatures, and cooling rates specific to the nickel-based superalloy IN939 (Vogt et al., col. 3, lines 27-32). Thus, it would be obvious to one of ordinary skill in the art to apply a different cooling rate if a different superalloy were employed. Additionally, it is well held that discovering an optimum value of a result-effective variable involves only routine skill in the art (MPEP § 2144.05 Section II). In the instant case, cooling rate is a result-effective variable because it affects the properties and microstructure of quenched steel (page 270, para. 12.40). While the teaching is drawn to steel (iron-based), it would be within one of ordinary skill in the art to extend the principle to nickel alloys, as they belong to the same group in the periodic table of elements. Therefore, it would have been obvious to one of ordinary skill in the art to have optimized the cooling rate of Vogt et al. in order to obtain a desired end-result microstructure.

Regarding claim 28, the nickel-based superalloy is subjected to additional heat treatment after fusion welding to modify the mechanical properties of said superalloy (Vogt et al., col. 4, lines 14-16).

Regarding claim 29, the post-weld heat treatment comprises heating the superalloy at a temperature above the gamma prime solvus temperature (Vogt et al., col. 4, lines 14-19). (Note: 2120°F is above the solvus gamma prime solvus temperature – see Vogt et al., col. 3, lines 35-38). Heating above the solvus temperature induces the gamma prime phase to go into solution, thereby partially reversing the coarsening induced by the preweld heat treatment step.

Regarding claim 39, the IN939 material may be repair welded using Nimonic 263, which has a composition similar to IN939. Both alloys include similar proportions of cobalt, chromium, titanium, and aluminum (Vogt et al., col. 4, lines 6-14).

Regarding claim 43, the exemplary alloy is IN939 (Vogt et al., col. 3, lines 27-32).

Regarding claim 45, the preweld heat treatment takes place above the gamma prime solvus temperature for a time sufficient to bring the gamma prime phase into solution (Vogt et al., col. 3, lines 35-40).

Regarding claim 46, the overaging heat treatment takes place above 2100°F (1149°C), which encompasses 1180°C (Vogt et al., col. 3, lines 35-37).

Regarding claim 47, the heat treatment following welding occurs at 2120°F, which is above the gamma prime solvus temperature (Vogt et al., col. 4, lines 15-21), and therefore, sufficient to bring the gamma prime phase into solution (Vogt et al., col. 3, lines 35-38).

Regarding claim 48, Vogt et al. are silent as to a specific cooling rate for the post-weld heat treatment. However, it is understood by those of ordinary skill in the art that the cooling rate can be adjusted and will vary depending on the superalloy employed

(Vogt et al., col. 3, lines 27-32). Thus, it would be obvious to one of ordinary skill in the art to apply a different cooling rate if a different superalloy were employed. Additionally, it is well held that discovering an optimum value of a result-effective variable involves only routine skill in the art (MPEP § 2144.05 Section II). In the instant case, cooling rate is a result-effective variable because it affects the properties and microstructure of quenched steel (page 270, para. 12.40). While the teaching is drawn to steel (iron-based), it would be within one of ordinary skill in the art to extend the principle to nickel alloys, as they belong to the same group in the periodic table of elements. Therefore, it would have been obvious to one of ordinary skill in the art to have optimized the cooling rate of Vogt et al. in order to obtain a desired end-result microstructure.

Claims 36 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vogt et al. (US 6,120,624) in view of Lake (US 1,531,445), and further in view of Higgins (*Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th edition) and Hashiguchi (US 2002/0162611).

Regarding claim 36, Vogt et al. in view of Lake and Higgins do not specifically identify hot isostatic pressing as a method of redensification. Hashiguchi teaches hot isostatically pressing castings in order to drastically reduce porosity in metal components (para. [0010]). Therefore, it would have been obvious to one of ordinary skill in the art to implement hot isostatic pressing (HIP) as a redensification method in the process of Vogt et al. in view of Lake and Higgins because HIP closes pores, as

taught by Hashiguchi, thereby improving the mechanical properties of the finished metal component.

Regarding claim 50, Vogt et al. in view of Lake and Higgins fail to teach that re-densification occurs at a temperature below the solidus line of the material. However, it is known to the skilled artisan that re-densification processes, such as hot isostatic pressing, typically take place below the solidus temperature of an alloy to prevent shape distortion of the alloy during casting, as evidenced by Hashiguchi (para. [0030]). Therefore, it would have been obvious to one of ordinary skill in the art to redensify the metal casting of Lake below the solidus temperature, as taught by Hashiguchi, because redensifying at a temperature in that range reduces distortion of the metal component.

Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vogt et al. (US 6,120,624) in view of Lake (US 1,531,445), and further in view of Higgins (*Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th edition) and Heitman et al. (US 5,071,059).

Regarding claim 40, Vogt et al. in view of Lake and Higgins teach that the weld filler may be of a material similar to the alloys to be welded, but fails to explicitly teach that the filler may be of the same material as the alloys being welded. Heitman et al. teach a method for welding nickel-based superalloys, wherein the filler material is preferably identical in chemical composition to the alloys being welded (col. 3, lines 62-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a filler material identical to the nickel base superalloys being welded in

Vogt et al. because doing so would eliminate the possibility of forming an alloy with inferior mechanical properties in the heat-affected zone.

Regarding claim 41, Heitman et al. teach that it is preferable for the weld filler to be of the same composition as the workpieces being welded (col. 3, lines 62-68). Thus, in the case the workpieces are superalloys, the weld filler would also be a superalloy, and because superalloys are capable of being precipitation hardened, the weld filler material must also necessarily be capable of being precipitation hardened.

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vogt et al. (US 6,120,624) in view of Lake (US 1,531,445), and further in view of Higgins (*Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th edition) and Yoshida et al. (US 4,491,001).

Regarding claim 42, Vogt et al. in view of Lake and Higgins fail to teach a hammering step after welding. However, imposing mechanical deformation to welded joints is well known in the welding arts, as evidenced by Yoshida et al., wherein a welded joint is hammered in order to relieve residual tensile stresses (col. 2, lines 62-68 to col. 2, lines 1-2). Therefore, it would be obvious to one of ordinary skill in the art to further hammer the weld location because doing so releases internal stresses created during the bonding process.

Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vogt et al. (US 6,120,624) in view of Lake (US 1,531,445), and further in view of Higgins

(*Engineering Metallurgy, Part I: Applied Physical Metallurgy*, 6th edition), Heitman et al. (US 5,071,059), and Schweizer et al. (US 4,222,794).

Regarding Claim 49, Vogt et al. in view of Lake, Higgins, and Heitman et al. do not teach a particular volume percent of precipitations of the weld filler. However, it is not unusual for the amount of gamma prime phase precipitates in nickel-based superalloys to be up to 60 percent by volume, which overlaps the claimed range, as taught by Schweizer et al. (col. 2, lines 8-10). Thus, it would be obvious to one of ordinary skill in the art at the time of the invention to ensure that the precipitations in the weld filler amount to at least 35 vol.% because the presence of a relatively large volume of precipitates would strengthen the joint at which the two superalloys are welded.

Response to Arguments

Applicant's arguments with respect to the references of Vogt et al. in view of Schirra et al. have been considered but are moot in view of the new grounds of rejection necessitated by amendment.

Conclusion

Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vanessa Velasquez whose telephone number is (571)270-3587. The examiner can normally be reached on Monday-Friday 8:30 AM-6:00 PM ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King, can be reached at 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Roy King/
Supervisory Patent Examiner, Art Unit 1793

/Vanessa Velasquez/
Examiner, Art Unit 1793